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Pappalardo

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(54) **STATIC MIXER**

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(51) **Int. Cl.**
B01F 5/06 (2006.01)

(52) **U.S. Cl.** **366/337**

(58) **Field of Classification Search** 366/336, 366/337, 340
See application file for complete search history.

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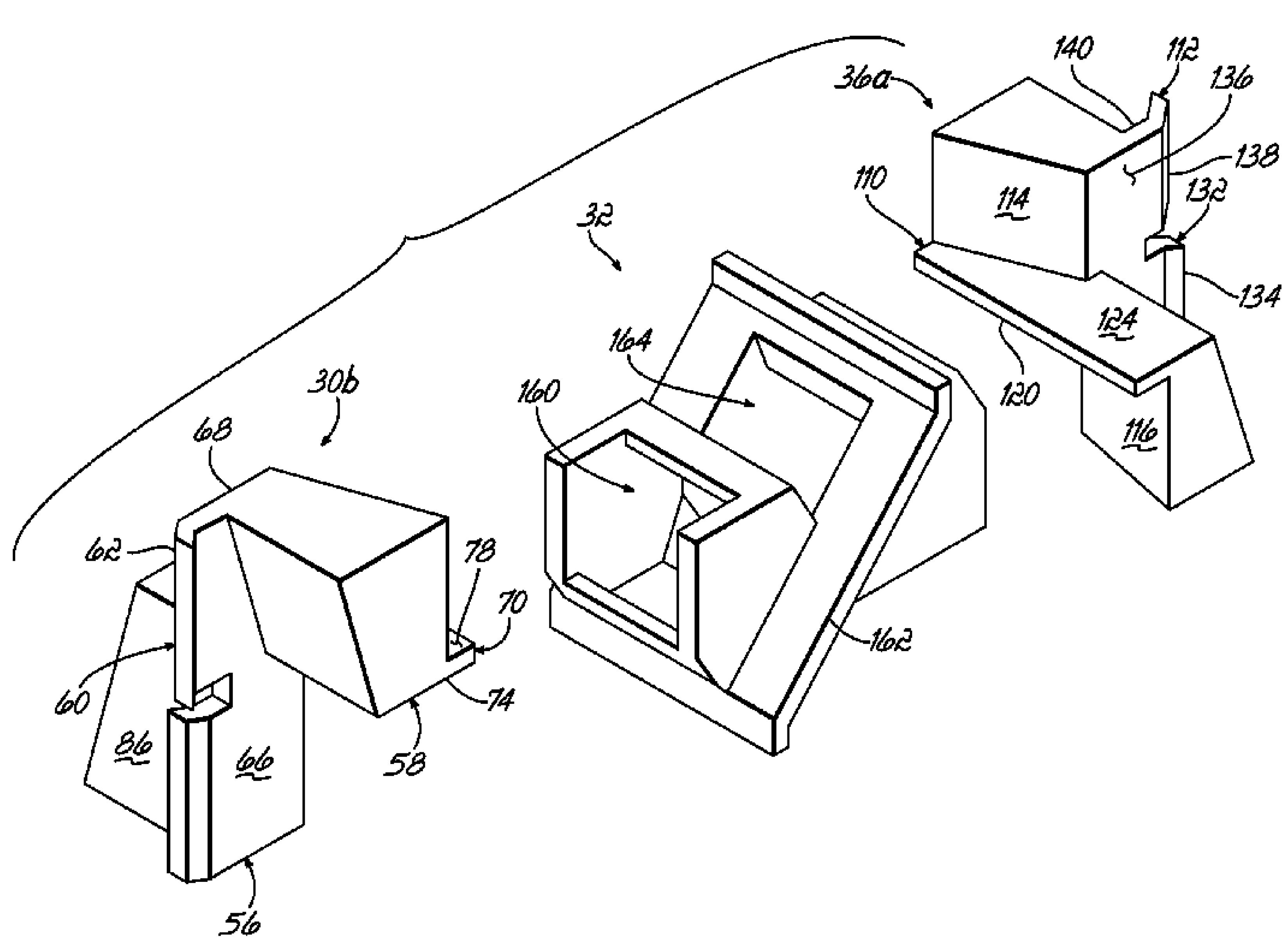
(57) **ABSTRACT**

A mixer for mixing at least first and second fluids comprises a conduit configured to receive a stream of the first and second fluids. A first series of mixing elements are disposed within the conduit and configured to divide the stream in a first direction. A second series of mixing elements are disposed within the conduit and configured to divide the stream in a second direction different from the first direction. The mixing elements of the first series each comprises a first planar member oriented in the first direction and defining a leading edge, a second planar member oriented in the second direction and defining a trailing edge, a first deflecting surface extending outwardly from a first side of the first planar member and configured to direct fluid flow to a space adjacent a first side of the second planar member, and a second deflecting surface extending outwardly from a second side of the first planar member and configured to direct fluid flow to a space adjacent a second side of the second planar member.

22 Claims, 5 Drawing Sheets



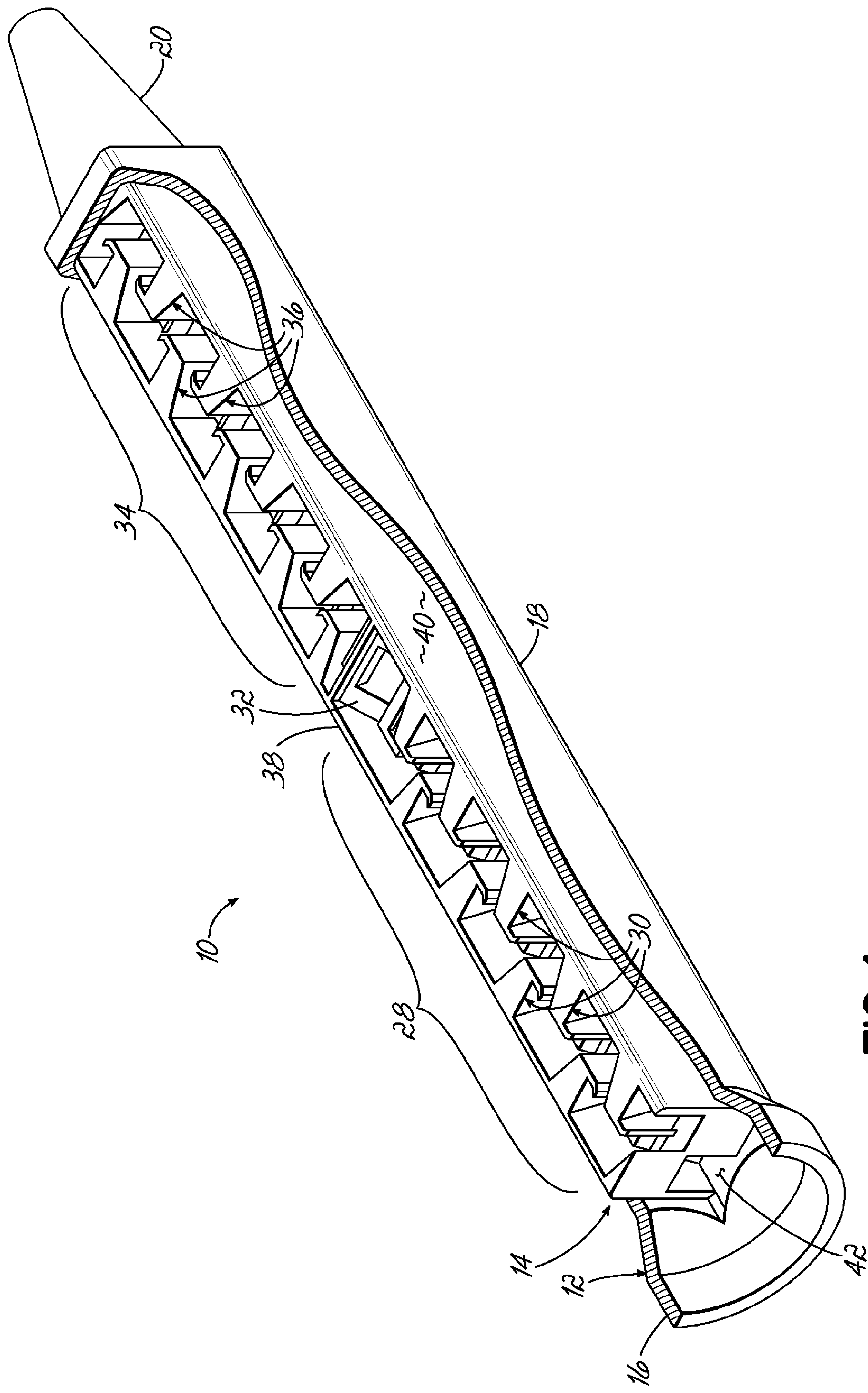


FIG. 1

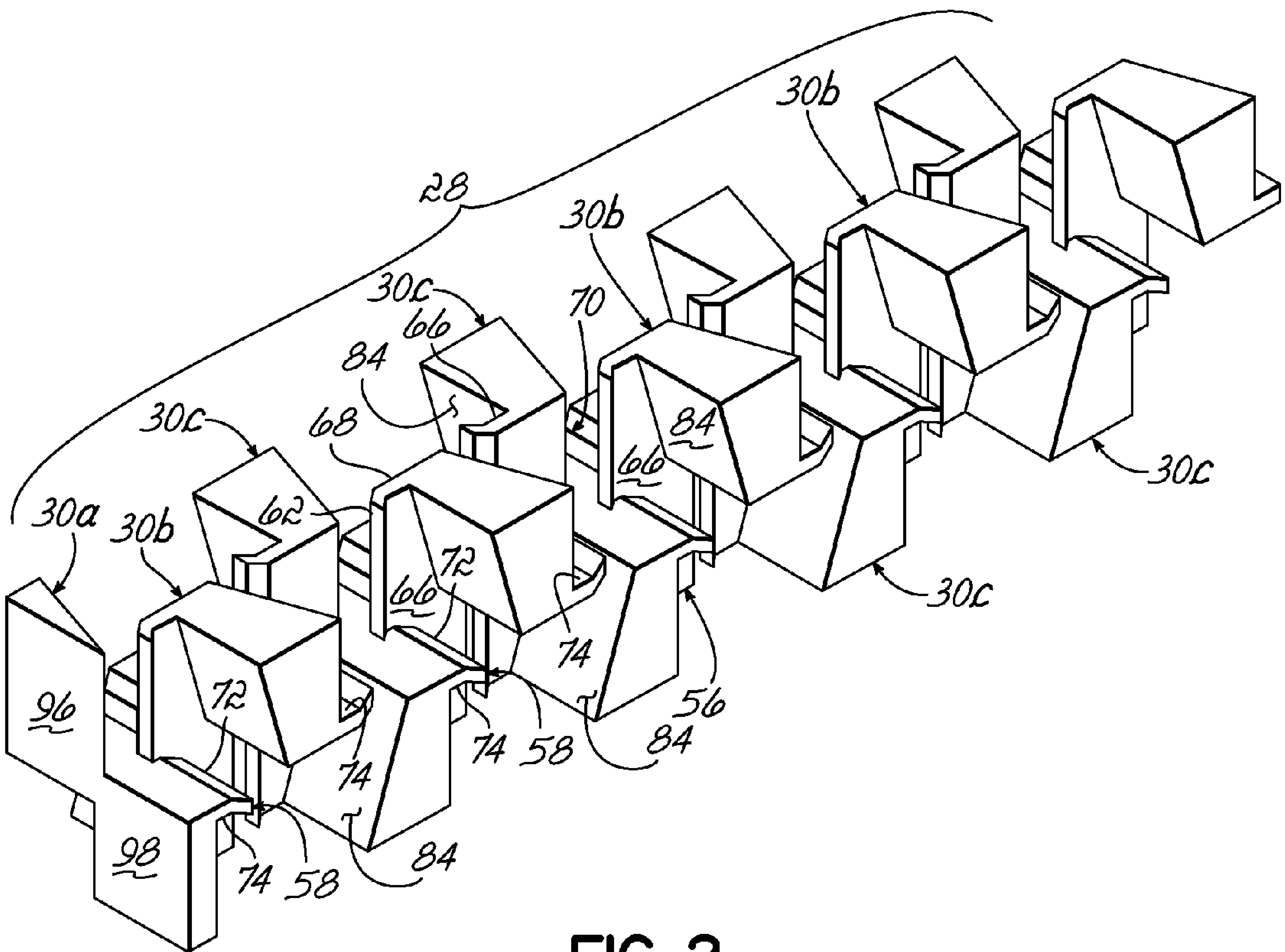


FIG. 2

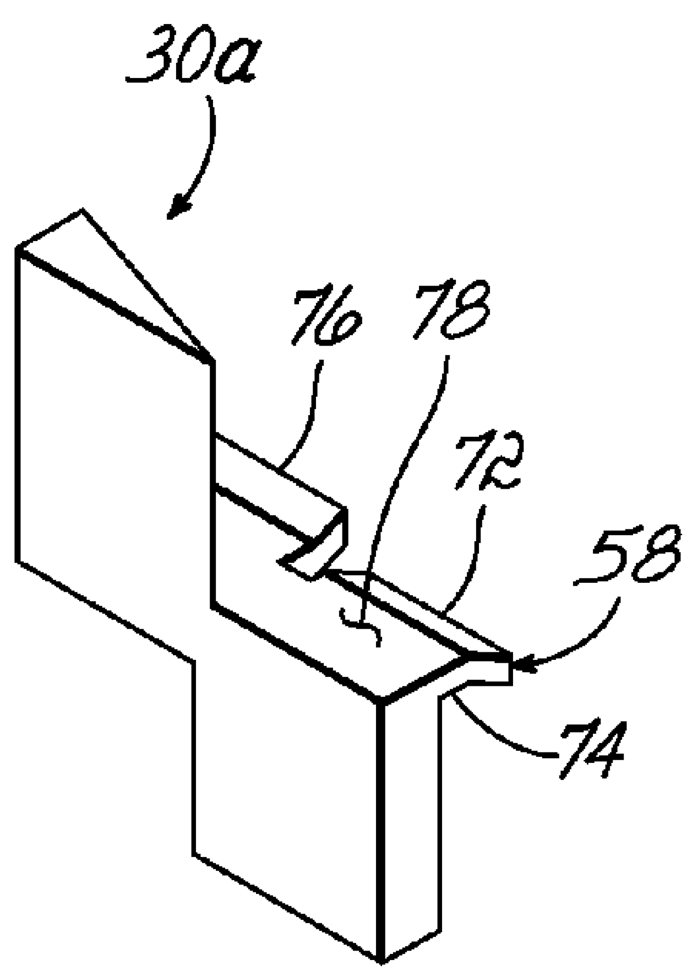


FIG. 2A

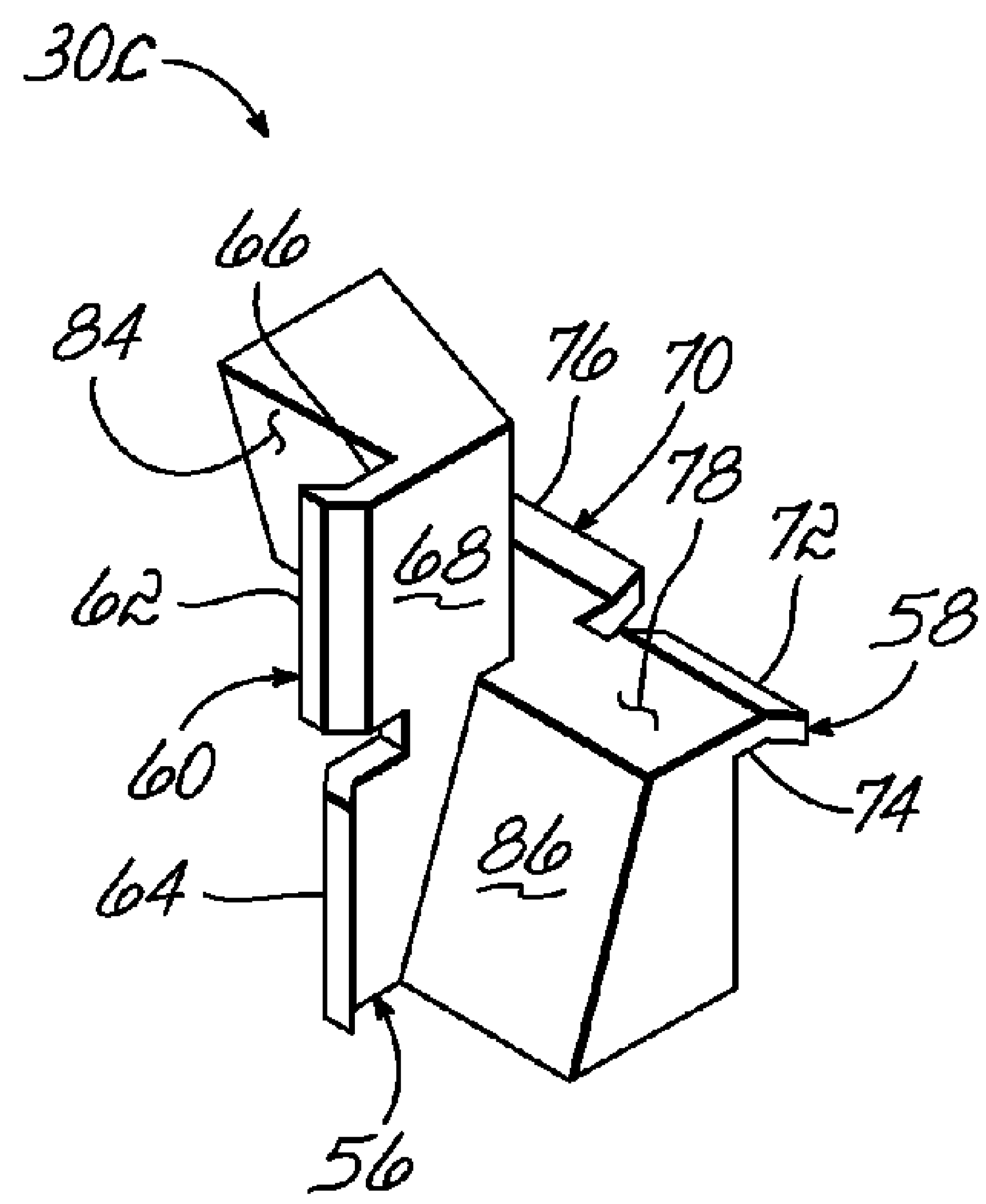


FIG. 2C

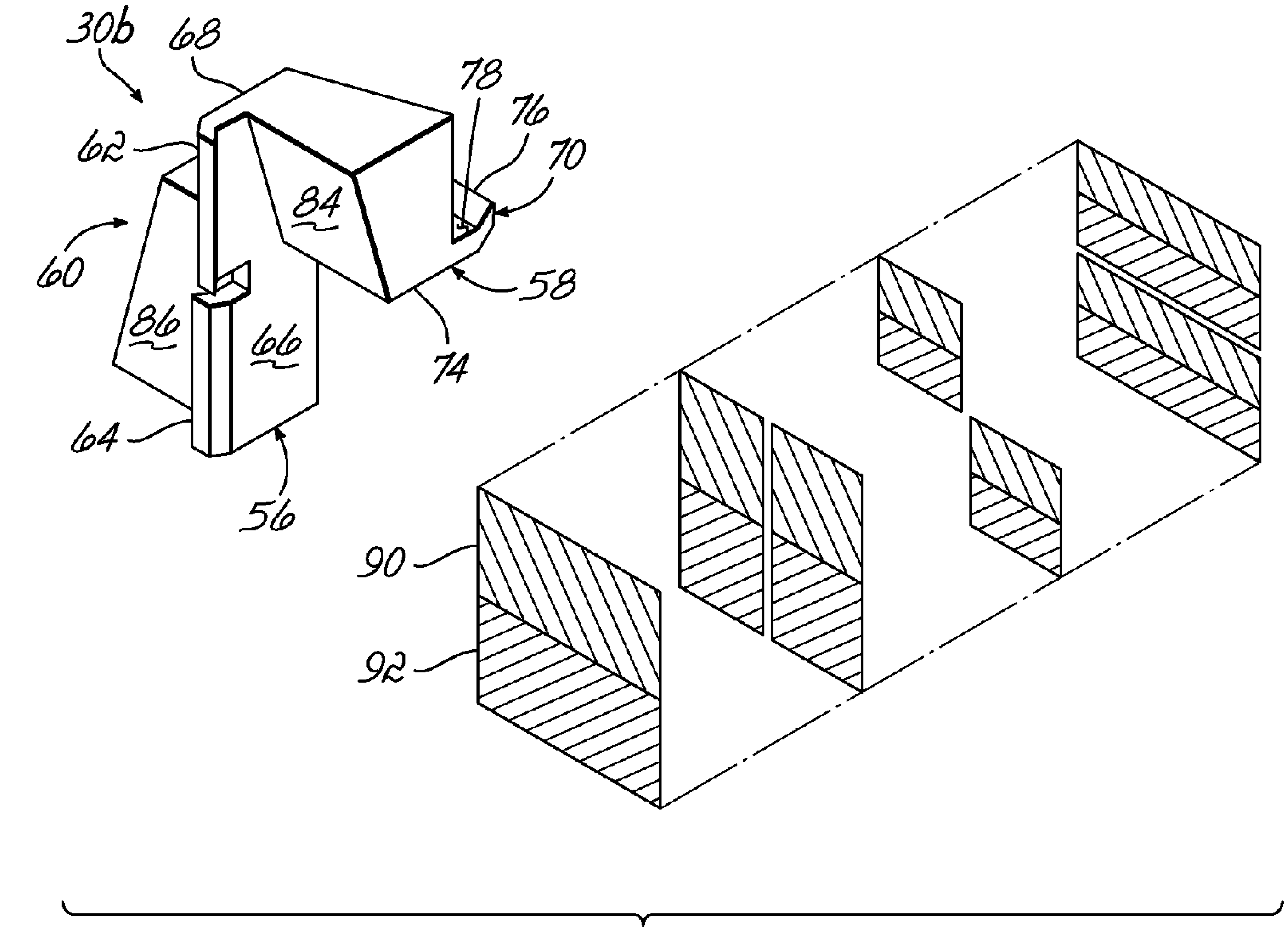

30b
68
78
76
70
62
84
60
86
66
58
74
64
56
90
92

FIG. 2B

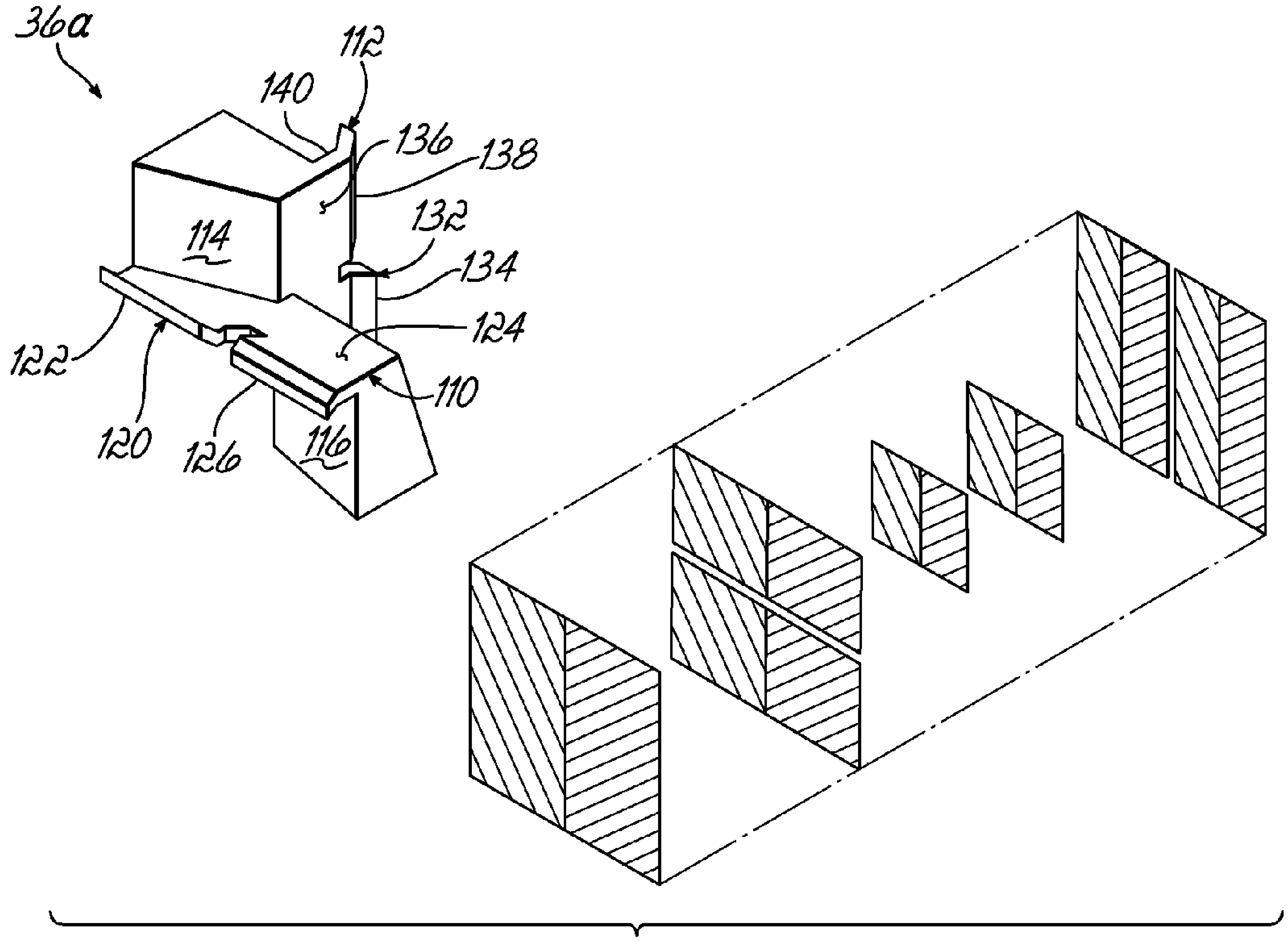

36a
112
140
136
138
114
132
134
124
122
110
120
126
116

FIG. 3A

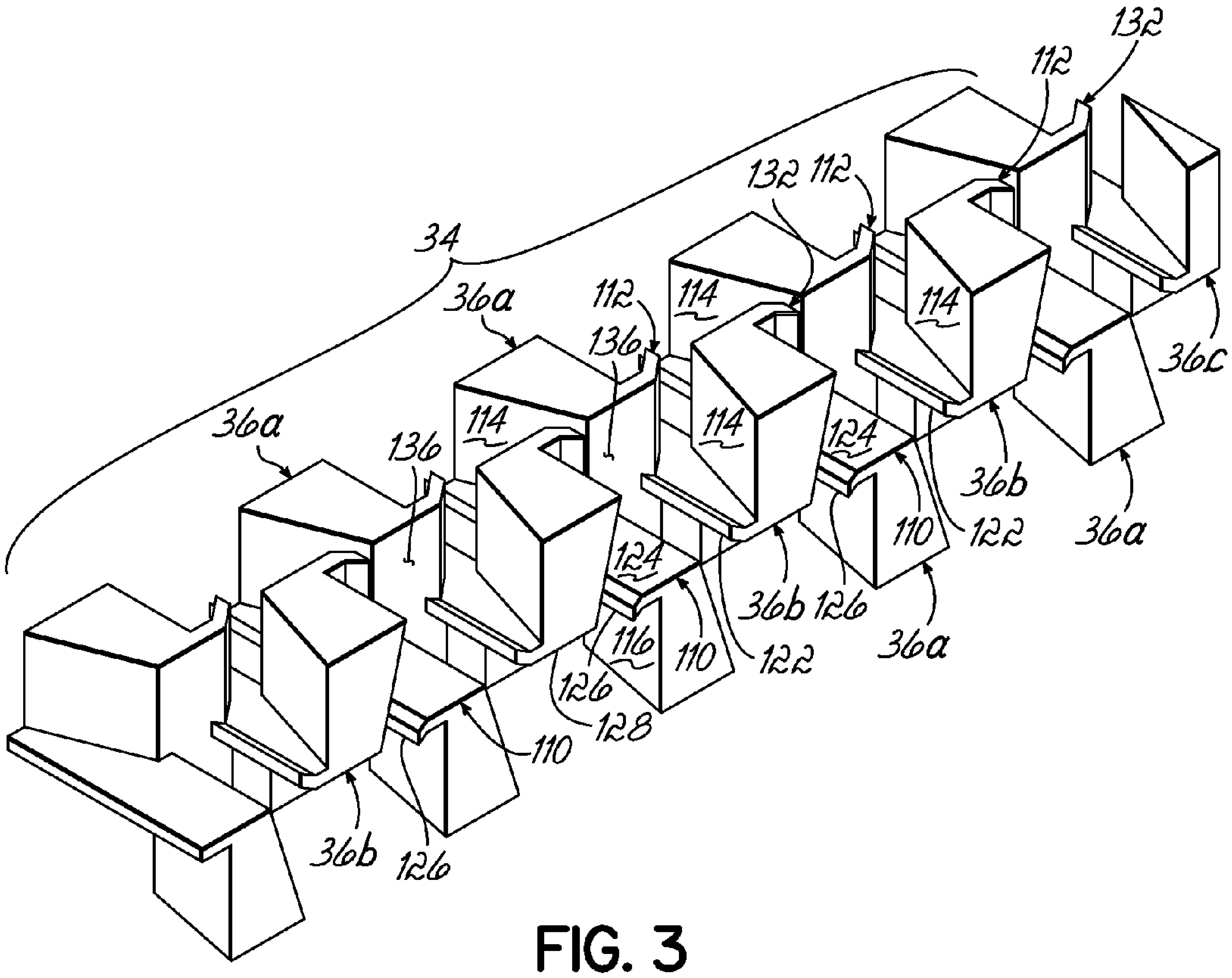


FIG. 3

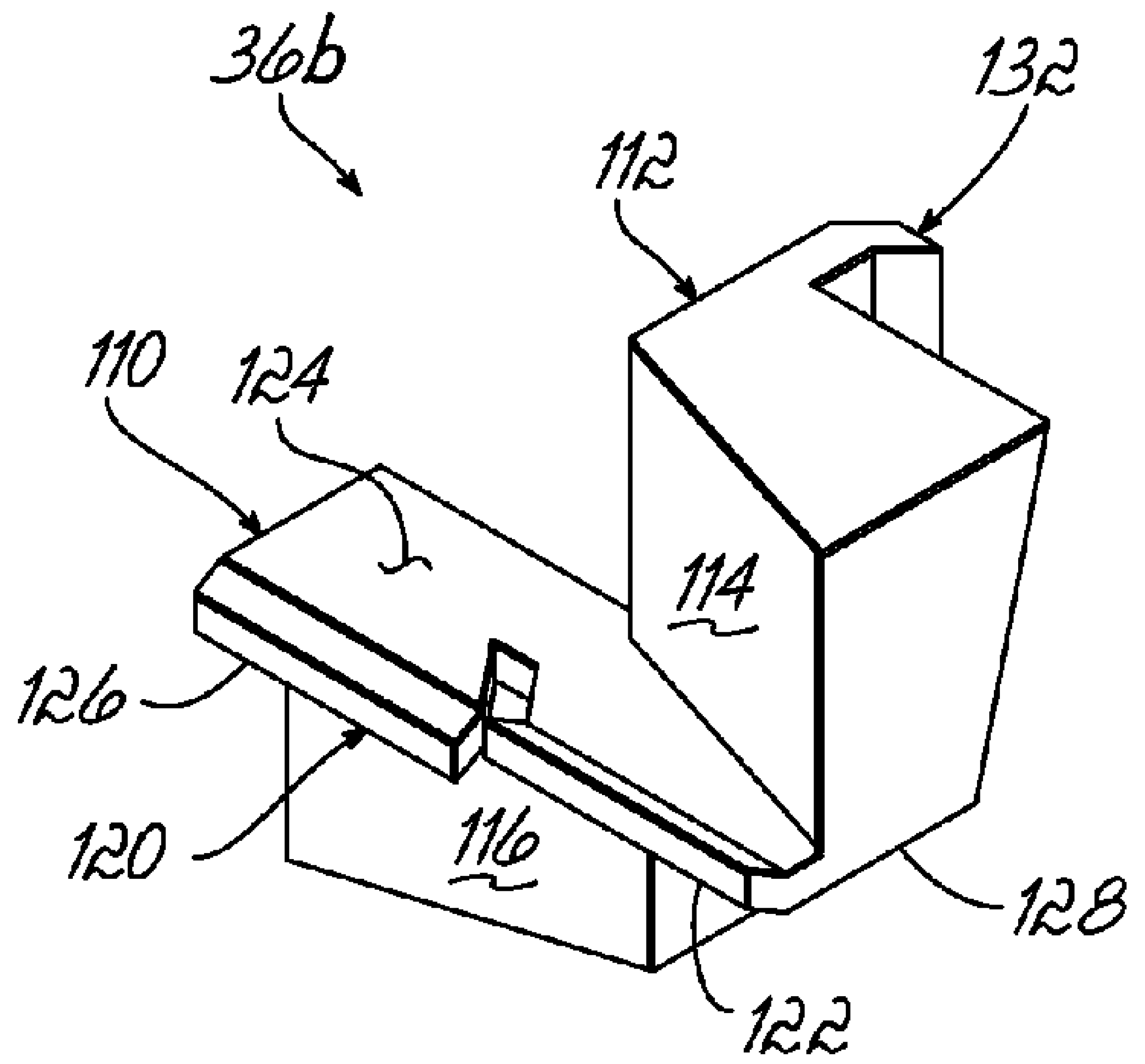


FIG. 3B

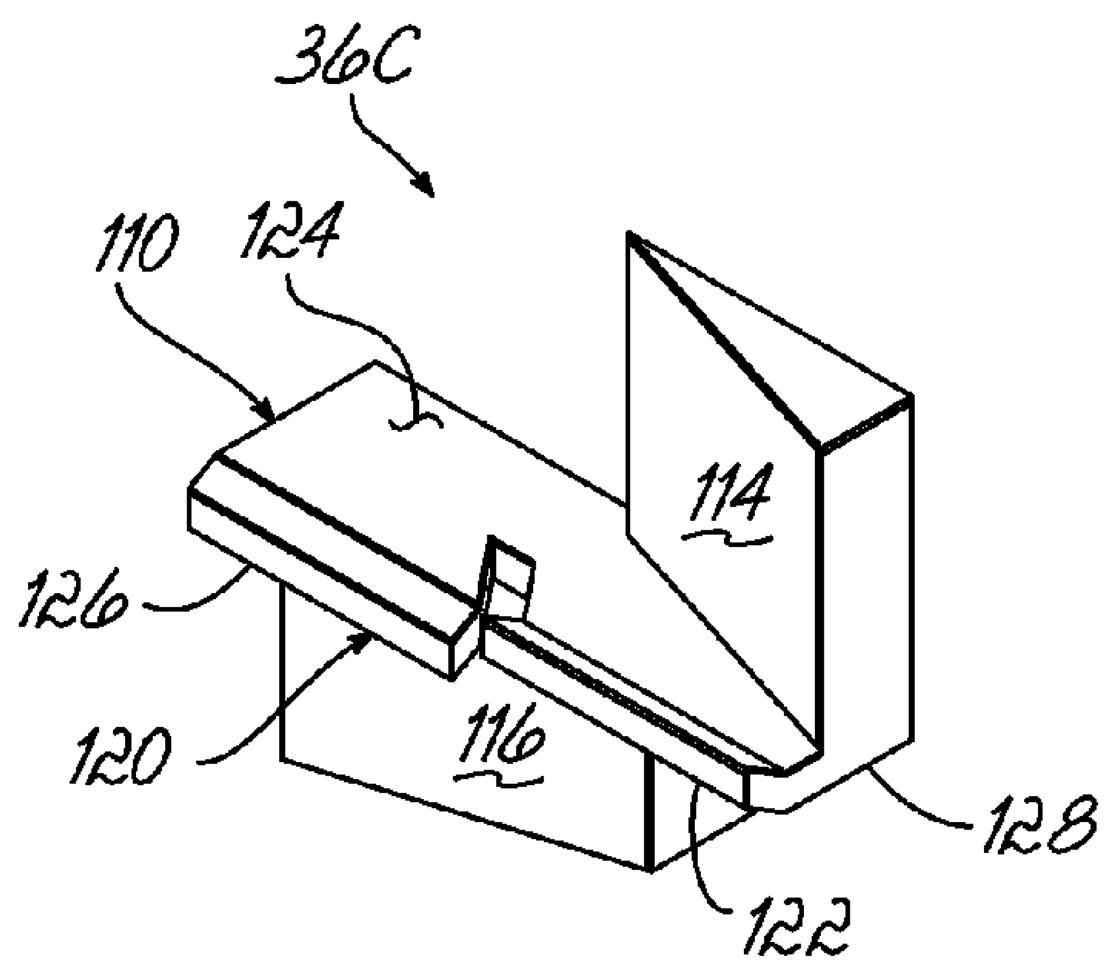


FIG. 3C

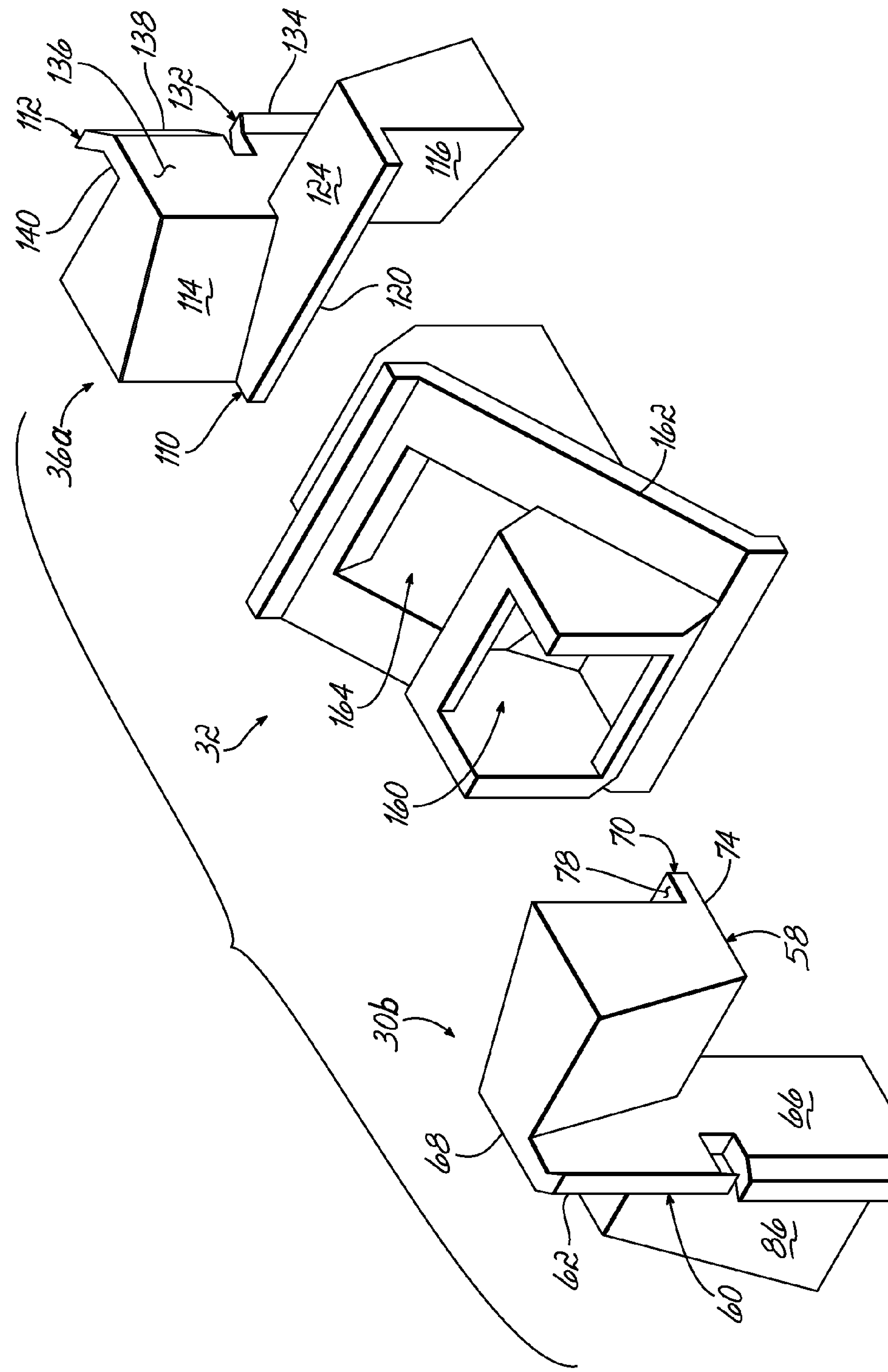

112
136
138
132
134
140
114
124
116
120
110
36a
162
164
32
160
70
78
74
58
30b
66
56
68
62
86
60

FIG. 4

STATIC MIXER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/061,424, filed Jun. 13, 2008, the disclosure of which is hereby incorporated by reference herein in its entirety.

TECHNICAL FIELD

The present invention relates generally to a device for mixing two or more fluids together, and more particularly to a static mixer having mixing elements that divide a fluid stream in different directions and/or a static mixer having mixing elements that do not require orientation during assembly of the mixer.

BACKGROUND

Many applications require two or more fluids to be mixed together. For example, two-component adhesives and sealants include a base component and activator component that must be mixed together prior to use. This mixing can be accomplished by forcing each component into and through a motionless (i.e., static) mixer. Such mixers include a mixing component or assembly disposed within a conduit, with the mixing component having a series of interconnected mixing elements in the form of baffles, spirals, wedges, and/or deflection plates. The mixing elements divide and recombine the fluids in an overlapping manner to produce layers of the fluids. Eventually this division and recombination causes the layers to thin and diffuse past one another, resulting in a substantially uniform mixture.

The mixing elements comprised of baffles in conventional static multiflux mixers, examples of which are shown in U.S. Pat. Nos. 6,773,156 and 3,239,197, and plate multiflux mixers, an example of which is shown in U.S. Pat. No. 5,944,419, are oriented in one specific longitudinal direction (relative to the conduit of the mixer) and configured to divide the fluid stream in the same transversal direction (e.g., an X or Y direction). Such an arrangement is desirable because alternating the dividing direction may defeat the purpose of the mixing elements. In particular, when a mixing element that divides in an X-direction and recombines in a Y-direction is immediately followed by a mixing element that divides Y-direction and recombines in the X-direction, the mixing accomplished by the first mixing element may be effectively "undone" by the second mixing element.

One of the challenges associated with the conventional mixing arrangement described above is the elimination of streaks in the extruded mixture. For example, when mixing together fluids of different viscosities, there is a tendency for the low viscosity fluid to channel or "zig-zag" along the interior walls of the conduit instead of being properly included in the layering process. This results in a streak of the unmixed fluid within the extruded mixture dispensed from the static mixer. Such streaks are undesirable for a variety of reasons. They may affect the performance of the product or they may cause the operator of the static mixer to question whether it has effectively mixed the two components or fluids of the adhesive or sealant in cases where the streak does not affect performance.

Several attempts have been made to eliminate streaking by incorporating various additional mixing features, such as webs, varying baffle sizes, and varying baffle geometries, in

the series of interconnected mixing elements. However, current technologies leave room for improvement when mixing difficult materials. Streaks still occur with certain materials, requiring the end user to use longer mixers, which are disadvantageous for many reasons. Longer mixers are less manageable to use and generally have a higher retained volume, wasting more fluid when the mixer is disposed. Many elements are designed to be oriented in a specific longitudinal direction when inserted into the conduit of the mixer. Thus, for the fluids to move through the specially designed geometry in the proper direction, the manufacturer must properly orient the mixing elements during assembly of the mixer. Orienting the mixer during assembly adds cost, time, and complexity to the manufacturing process. Many manufactures provide orientation tabs or other structure on the component to ensure that it is inserted into the conduit in the proper direction.

Therefore, a mixer that reduces streaking and/or does not require an orientation step during assembly is highly desirable.

SUMMARY

The present invention generally provides a mixer for mixing at least first and second fluids. The mixer includes a conduit configured to receive a stream of the first and second fluids, and a mixing component positioned within the conduit. The mixing component generally comprises a first series of mixing elements, each configured to divide the stream in a first direction and recombine the stream in a second direction. The mixing component further includes a second series of mixing elements each configured to divide the stream in a third direction different from the first direction and recombine the stream in a fourth direction different from the second direction.

Various embodiments of the invention are provided including, for example, an embodiment in which the mixing elements of the first series each comprises a first planar member oriented in a first direction and defining a leading, stream dividing edge, a second planar member oriented in the second direction and defining a trailing, stream recombining edge, a first deflecting surface extending outwardly from a first side of the first planar member and configured to direct fluid flow to a space adjacent a first side of the second planar member, and a second deflecting surface extending outwardly from a second side of the first planar member and configured to direct fluid flow to a space adjacent a second side of the second planar member. The first and second directions may be substantially perpendicular to each other. The mixing elements of the first series may be configured to recombine the stream in the second direction and/or the mixing elements of the second series may each be configured to recombine the stream in the first direction. An auxiliary baffle may be positioned between a mixing element of the first series and a mixing of the second series and configured to redirect portions of the stream. For example, the auxiliary baffle may comprise a flow inversion baffle configured to direct portions of the stream in a center of the conduit to a periphery of the conduit and direct portions of the stream in the periphery of the conduit to the center of the conduit. A plurality of auxiliary baffles may be used throughout the mixing component in any desired sequence. The various mixing elements, including the auxiliary baffle or baffles may be interconnected in any desired manner, or formed as independent units and placed adjacent to each other and otherwise held within the conduit.

Various other features will become readily apparent upon review of the following detailed description of the illustrative embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a mixer according to one embodiment with a portion of a conduit wall removed.

FIG. **2** is a perspective view of a first series of interconnected baffles from the mixer of FIG. **1** with leading edges oriented in a first direction.

FIG. **2**A is a perspective view of the first baffle in the series of FIG. **2**.

FIG. **2**B is a perspective view of a baffle of FIG. **2** having a first orientation, and schematically illustrates the mixing process of the baffle.

FIG. **2**C is a perspective view of a baffle of FIG. **2** having a second orientation.

FIG. **3** is a perspective view of a second series of interconnected baffles from the mixer of FIG. **1** with leading edges oriented in a second direction.

FIG. **3**A is a perspective view of a baffle of FIG. **3** having a first orientation, and schematically illustrates the mixing process of the baffle.

FIG. **3**B is a perspective view of a baffle of FIG. **3** having a second orientation.

FIG. **3**C is a perspective view of the last baffle in the series of FIG. **3**.

FIG. **4** is a perspective view of a flow inversion baffle positioned between the last baffle in the first series of interconnected baffles and the first baffle in the second series of interconnected baffles.

DETAILED DESCRIPTION

With reference to FIG. **1** one embodiment of a mixer **10** is shown. The mixer **10** generally comprises a conduit **12** and a mixing component **14** inserted into the conduit **12**. The conduit **12** defines an inlet end **16** configured to be attached to a cartridge, cartridge system, or metering system (none of which are shown) containing at least two fluids to be mixed together. For example, the inlet end **16** may be connected to any of the two-component cartridge systems available from TAH Industries, Inc. The conduit **12** also includes a body section **18** shaped to receive the mixing component **14** and a nozzle outlet **20** communicating with the body section **18**. Although the body section **18** and mixing component **14** are shown as having substantially square cross-sectional profiles, those skilled in the art will appreciate that the concepts described below may equally apply to mixers with other geometries.

The mixing component **14** of the embodiment shown in FIG. **1** includes a first series **28** of mixing elements or baffles **30**, a flow inversion element or baffle **32**, and a second series **34** of mixing elements or baffles **36**, each integrally molded with and disposed between first and second sidewalls **38**, **40**. The first and second sidewalls **38**, **40** bound opposite sides of the mixing component **14**, whereas sides of the mixing component **14** between the first and second sidewalls **38**, **40** remain exposed to an associated interior surface **42** of the conduit **12** (one of the interior surfaces **42** is not shown in FIG. **1**). The number of baffles **30**, **32**, and **36**, along with their respective shapes, may vary. Thus, although the structure shown in FIG. **1** will be described in considerable detail below, the mixer **10** is merely one example of an embodiment incorporating aspects of the invention.

Now referring to FIGS. **2** and **2**A-**2**C, the first series **28** is illustrates in further detail. The first and second sidewalls **38**, **40** (FIG. **1**) of the mixing component **14** are not shown for clarity. The first series **28** begins with a partial baffle **30***a* and then alternates between baffles **30***b* having a first configuration and baffles **30***c* having a second configuration. The first and second configurations are similar, but reversed about at least one center plane aligned parallel to a longitudinal axis of the mixing component **14** and conduit **12** such that the baffles **30***b* and **30***c* are mirror images of each other. The baffles **30***b* having the first configuration are sometimes referred to as "right-handed" baffles, and the baffles **30***c* having the second configuration are sometimes referred to as "left-handed" baffles. Because of their similar construction, like reference numbers will be used to identify the structure of the baffles **30***a*, **30***b*, and **30***c*. Additionally, reference number **30** will be used to generically refer to the baffles **30***a*, **30***b*, and **30***c* of the first series **28** where appropriate (e.g., discussion of FIG. **1** above).

The baffles **30***b* (FIG. **2**B) and **30***c* (FIG. **2**C) each include a first planar member **56** oriented in a first direction, which is shown as a generally vertical direction ("Y-direction") in the illustrative embodiment, and a second planar member **58** oriented in a second direction, which is shown as a generally horizontal direction ("X-direction"). The first planar member **56** extends in a direction parallel to a longitudinal axis of the mixing component **14** and terminates in a leading edge **60** defined by first and second sections **62**, **64**. The first section **62** is slightly angled, or "hooked," toward a first side **66** of the first planar member **56**, and the second section **64** is slightly angled, or "hooked," toward a second side **68** of the first planar member **56**. The second planar member **58** has a shape similar to the first planar member **56**, but defines a trailing edge **70**. To this end, the trailing edge **70** likewise includes a first section **72** slightly angled toward a first side **74** of the second planar member **58** and a second section **76** slightly angled toward a second side **78** of the second planar member **58**.

The baffles **30***b*, **30***c* further include first and second deflecting surfaces **84**, **86** extending outwardly from the first planar member **56**. The first deflecting surface **84** is configured to direct fluid downwardly toward the space adjacent the first side **74** of the second planar member **58**. The second deflecting surface **86** is configured to direct fluid upwardly to the space adjacent the second side **78** of the second planar member **58**.

FIG. **2**B illustrates the mixing characteristics of one of the baffles **30***b*. Two unmixed fluids **90**, **92** are introduced into the mixer **10**. When the two fluids **90**, **92** intersect the leading edge **60** of the first planar member **56**, the fluid flow is divided in a generally vertical direction. The divided flows are then shifted vertically in opposite directions by the first and second deflecting surfaces **84**, **86** as the fluid stream continues to flow over the baffle **30***b*. After flowing past the first planar member **56**, the divided flows expand laterally across the width of the second planar member **58** and are positioned in an overlapping manner. The fluids **90**, **92** are effectively "recombined" in this latter step. As can be seen, one of the baffles **30***b* doubles the number of layers of the fluids **90**, **92**.

The baffles **30***b* (FIG. **2**B) may be interconnected with the baffles **30***c* (FIG. **2**C), which operate upon the same principles because of their similar structure. Alternatively, the various baffles **30** may be independent units and simply held adjacent one another by other structure. The mixing characteristics of the baffles **30***c* are therefore clear from the description given of baffles **30***b*. The partial baffle **30***a* (FIG. **2**A) also operates in a similar manner to the baffles **30***b*, but does not include the first planar member **56** or the first and second deflecting surfaces **84**, **86**. Instead, the partial baffle **30***a* includes first and second end surfaces **96**, **98** aligned in the same plane. The first and second end surfaces **96**, **98** effectively block fluid flow in opposite corners of the mixing component **14**. As a result, a stream of two or more fluids must divide and shift to one of the open spaces adjacent the first and second end surfaces **96**, **98** before "recombining" (i.e., extending) across the width of the second planar member **58**.

Each of the baffles **30***a*, **30***b*, and **30***c* thus divide and recombine a fluid stream to double the number of layers in the fluid stream. Because the first series **28** includes a total of ten baffles, the first series **28** is capable of dividing a fluid stream of two materials into 2048 layers of alternating material (layers=2 materials×2^n, where n is the number of baffles). The presence of the partial baffle **30***a* helps reduce the overall length of the first series **28**. In alternative embodiments, however, the partial baffle **30***a* may be eliminated or replaced with one of the baffles **30***c* such that the first series **28** consists only of the baffles **30***b* and **30***c*. There may also be a larger or smaller number of total baffles **30** in the first series **28** in alternative embodiments.

FIGS. **3** and **3A-3C** illustrate the second series **34** of baffles **36** (FIG. **1**) in further detail. Again, the first and second sidewalls **38**, **40** of the mixing component **14** are not shown for clarity. The second series **34** is similar to the first series **28** in that it alternates between baffles **36***a* having a first configuration and baffles **36***b* having a second configuration, with baffles **36***a* being mirror images of the baffles **36***b*. Baffles **36***a*, **36** each include first and second planar members **110**, **112** and first and second deflecting surfaces **114**, **116**. The baffles **36***a*, **36***b*, are similar to baffles **30***b*, **30***c* of the first embodiment but are oriented in different directions than the baffles **30***b*, **30***c*. More specifically, the first planar members **110** each define a leading edge **120** oriented in the second direction (X-direction) rather than in the first direction (Y-direction). The leading edge **120** includes a first section **122** hooked toward a first side **124** of the first planar member **110** and a second section **126** hooked toward a second side **128** of the first planar member **110**. On the other hand, the second planar members **112** each define a trailing edge **132** oriented in the first direction (Y-direction) rather than in the second direction (X-direction). The trailing edge **132** includes a first section **134** hooked toward a first side **136** of the second planar member **112** and a second section **138** hooked toward a second side **140** of the second planar member **112**.

As schematically shown in FIG. 3A, each baffle **36***a* divides fluid flow in a generally horizontal direction due to the orientation of the first planar member **110**. The divided flows are then shifted laterally by the first and second deflecting surfaces **114**, **116** as the fluids **90**, **92** continue to flow over the baffle **36***a*. After flowing past the first planar member **110**, these flows expand vertically across the second planar member **112** to effectively recombine in an overlapping manner. Thus, the baffles **36***a* operate upon the same principles as the baffles **30***b*, but divide and recombine fluid flows in opposite **900** transversal directions. The same holds true when comparing the baffles **36***b* to the baffles **30***c*.

FIG. **4** schematically illustrates the flow inversion baffle **32** positioned between the last baffle **30***b* in the first series **28** (FIG. **2**) and the first baffle **36***a* in the second series **34** (FIG. **3**). The trailing edge **70** of the last baffle **30***b* in the first series **28** and the leading edge **120** of the first baffle **36***a* in the second series are not "hooked" to any side. The flow inversion baffle **32**, along with alternative designs thereof, are shown and described in U.S. Pat. No. 6,773,156 ("the '156 patent"), the disclosure of which is fully incorporated herein by reference. As described in the '156 patent, the flow inversion baffle **32** includes a center-to-perimeter flow chamber **160**, a flow diverter **162**, and a perimeter-to-center flow chamber **164** that cooperate to: 1) redirect fluid from the center of conduit **12** to a periphery of the conduit **12**, and 2) redirect fluid from the periphery of the conduit **12** to the center of the conduit **12**. For a more detailed explanation of the structure of the flow inversion baffle **32** and how this redirection is accomplished, reference can be made to the description in the '156 patent.

Advantageously, the flow inversion baffle **32** has rotational symmetry about a center plane perpendicular to a longitudinal axis of conduit **12**. Additionally, the second series **34** includes the same number of baffles as the first series **28** such that there are a total of 21 mixing elements (ten of the baffles **30**, one flow inversion baffle **32**, and ten of the baffles **36**) in the mixer **10**. Indeed, in the exemplary embodiment shown, the second series **34** is generally a mirror image of the first series **28** such that the entire mixing component **14** has rotational symmetry about the center plane. When viewing one of the open sides of the mixing component **14** (e.g., FIG. **1**), the baffles **30** in the first series **28** "hook" toward the inlet end **16** of the conduit **12** and the baffles **36** in the second series **34** "hook" toward the nozzle outlet **20** of the conduit **12**. The same arrangement and effect would be obtained if the mixing component **14** were inserted into the conduit **12** with a reverse orientation. Thus, the rotational symmetry of the mixing component **14** eliminates the need to orient the mixing component **14** in a particular longitudinal direction when assembling the mixer **10**.

In use, two fluids introduced into the conduit **12** are divided in the first direction into layers of alternating materials by the first series **28** of baffles **30**. These layers are then inverted and twisted by the flow inversion baffle **32**. Any material that "channels" or "zig-zags" along the interior surfaces **42** of the conduit **12** is directed from the periphery of the flow path into the center of the flow path. Upon exiting the flow inversion baffle **32**, the twisted and inverted layers are divided in the second direction by the second series **34** of baffles **36**.

By dividing the fluid stream in different directions, overall mixing quality is improved. Channeling is reduced not only by the flow inversion baffle **32**, but also because this undesirable side effect is more likely to occur on different sides of the mixing component **14** in the first and second series **28**, **34**. For example, in the first series **28**, channeling may only occur along the interior surfaces **42**, whereas in the second series **34**, channeling may only occur along the sidewalls **38**, **40** of the mixing component **14**. Any channeling that occurs in the first series **28** will be mixed up by the second series **34** rather than continuing to build up along the interior surface **42**.

These same advantages may be achieved in a wide variety of other mixer arrangements, as long as the mixer includes at least one mixing element or baffle configured to divide a fluid stream in a first direction and at least one mixing element or baffle configured to divide a fluid stream in a second direction different from the first direction. Therefore, the baffles **30** and **36** need not be arranged in the first and second series **28**, **34**. Nor do the baffles **30** and **36** have to be integrally molded as part of a unitary structure. There may also be a plurality of the flow inversion baffles **32** positioned throughout an arrangement of the baffles **30** and **36**.

Thus, while the invention has been illustrated by the description of one or more embodiments thereof, and while the embodiments have been described in considerable detail, they are not intended to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. As a further example, the first and second directions in which the fluid stream is divided need not be substantially perpendicular X and Y directions. To this end, the first series **28** of baffles **30** and second series **34** of baffles **36** may have different geometries. Additionally, although the mixer **10** includes the flow inversion baffle **32**, which is shown and described in the '156 patent, the mixer **10** may alternatively or additionally include an auxiliary baffle/relayering chamber, an example of which is shown in FIGS. 16a-e of U.S. Pat. No. 3,239,197 to Tollar ("the '197 patent"). The disclosure of the '197 patent is thus fully incorporated herein by reference.

While the present invention has been illustrated by a description of various preferred embodiments and while these embodiments have been described in some detail, it is not the intention of the Applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. The various features discussed herein may be used alone or in any combination depending on the needs and preferences of the user. This has been a description of illustrative aspects and embodiments the present invention, along with the preferred methods of practicing the present invention as currently known. However, the invention itself should only be defined by the appended claims.

What is claimed is:

1. A mixer for mixing at least first and second fluids, comprising:

a conduit configured to receive a stream of the first and second fluids; and

a first series of mixing elements disposed within the conduit and configured to divide the stream in a first direction; and

a second series of mixing elements disposed within the conduit and configured to divide the stream in a second direction different from the first direction;

wherein the mixing elements of the first series each comprises a first planar member oriented in the first direction and defining a leading, stream dividing edge, a second planar member oriented in the second direction and defining a trailing, stream recombining edge, a first deflecting surface extending outwardly from a first side of the first planar member and configured to direct fluid flow to a space adjacent a first side of the second planar member, and a second deflecting surface extending outwardly from a second side of the first planar member and configured to direct fluid flow to a space adjacent a second side of the second planar member.

2. The mixer of claim **1** wherein the first and second directions are substantially perpendicular to each other.

3. The mixer of claim **1** wherein the mixing elements of the first series are each configured to recombine the stream in the second direction.

4. The mixer of claim **3** wherein the mixing elements of the second series are each configured to recombine the stream in the first direction.

5. The mixer of claim **1** further comprising:

an auxiliary baffle positioned between a mixing element of the first series and a mixing element of the second series, the auxiliary baffle configured to redirect portions of the stream.

6. The mixer of claim **5**, wherein the auxiliary baffle further comprises:

a flow inversion baffle configured to direct portions of the stream in a center of the conduit to a periphery of the conduit and portions of the stream in the periphery of the conduit to the center of the conduit.

7. The mixer of claim **6** further comprising:

a plurality of the flow inversion baffles.

8. The mixer of claim **1**, wherein the first and second series of mixing elements are respectively configured and positioned in the conduit to form a rotational symmetric mixing component about a center plane perpendicular to a longitudinal axis of the conduit.

9. The mixer of claim **1**, wherein the first series of mixing elements further comprises a partial baffle defining a first end of the mixing component, the partial baffle having first and second end surfaces aligned in a plane perpendicular to a longitudinal axis of the conduit and arranged in opposite corners of the mixing component.

10. A mixer for mixing at least first and second fluids, comprising:

a conduit configured to receive a stream of the first and second fluids; and

a mixing component positioned within the conduit, the mixing component including:

a first series of mixing elements each configured to divide the stream in a first direction and recombine the stream in a second direction;

a second series of mixing elements each configured to divide the stream in a third direction different from the first direction and recombine the stream in a fourth direction different from the second direction; and

an auxiliary baffle positioned between two respective mixing elements of the first and second series, the auxiliary baffle configured to direct portions of the stream from a center of the conduit to a periphery of the conduit and portions of the stream from the periphery of the conduit to the center of the conduit.

11. The mixer of claim **10** wherein the first direction is substantially perpendicular to the second direction.

12. The mixer of claim **10**, wherein the third direction is substantially perpendicular to the fourth direction.

13. The mixer of claim **10**, wherein the third direction is the same as the second direction and the fourth direction is the same as the first direction.

14. The mixer of claim **10**, wherein the mixing component is rotationally symmetric about a center plane perpendicular to a longitudinal axis of the conduit.

15. The mixer of claim **10**, wherein the first series of mixing elements comprises a plurality of baffles having a first configuration and a plurality of baffles having a second configuration arranged in an alternating manner, the first configuration being a mirror image of the second configuration about at least one center plan parallel to a longitudinal axis of the conduit.

16. The mixer of claim **15**, wherein the baffles in the first series of mixing elements each include a first planar member oriented in the first direction and defining a leading edge, a second planar member oriented in the second direction and defining a trailing edge, a first deflecting surface extending outwardly from a first side of the first planar member and configured to direct fluid flow to a space adjacent a first side of the second planar member, and a second deflecting surface extending outwardly from a second side of the first planar member and configured to direct fluid flow to a space adjacent a second side of the second planar member.

17. The mixer of claim **16**, wherein the leading edge is defined by a first section hooked toward the first side of the first planar member and a second section hooked toward the second side of the first planar member.

18. The mixer of claim **16**, wherein the trailing edge is defined by a first section hooked toward the first side of the second planar member and a second section hooked toward the second side of the second planar member.

19. The mixer of claim 16, wherein the first series of mixing elements further comprises a partial baffle defining a first end of the mixing component, the partial baffle having first and second end surfaces aligned in a plane perpendicular to a longitudinal axis of the conduit and arranged in opposite corners of the mixing component.

20. The mixer of claim 19, wherein the second series of mixing elements is a mirror image of the first series of mixing elements about a center plane perpendicular to a longitudinal axis of the conduit.

21. The mixer of claim 10, wherein the mixing component further comprises:

first and second sidewalls defining opposite sides of the mixing component, the first series of mixing elements, second series of mixing elements, and a flow inversion baffle being disposed between the first and second sidewalls.

22. The mixer of claim 10, wherein the mixing component is integrally molded as a unitary structure.

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